an isothermal shock, which is the case when radiation is sufficiently strong to preserve the same temperature on both sides of the shock front. It is shown that the shock decays rapidly and ejects matter from the stellar surface in a manner which allows a simple interpretation of the observations. The effect on the results of the assumption described above is not serious and can be allowed for.

*Dominion Astrophysical Observatory,
Victoria, B. C.*

Rinehart, John S. Distribution of meteoritic debris about the Arizona meteorite crater.

It was pointed out several years ago by Nininger that large numbers of miniscule bits and pieces of meteoritic material are scattered through the soil in the neighborhood of the Arizona meteorite crater. We had an expedition in residence at the crater this past summer. The objective was to determine the distribution and nature of this material through the analysis of systematically taken samples.

Samples were taken over an eighty square-mile area. A specially designed magnetic separator was used to recover the meteoritic material.

Results are: (a) the concentration of meteoritic material in certain areas is as high as 0.6 per cent by weight of soil sample, (b) the total mass of meteoritic material in the region is between 10,000 and 15,000 ordinary tons, (c) in most regions the concentration decreases rapidly with soil depth, (d) the material is symmetrically distributed about a line that runs 15° north of east, and (e) the east-west distribution of material, while non-symmetrical, forms a perfectly definite pattern.

The last two results when taken in conjunction with other observations suggest strongly that the meteorite approached the crater from a direction slightly to the south of west rather than a north north-westerly direction as has been previously assumed.

*Smithsonian Astrophysical Observatory,
Cambridge, Mass.*

Sterne, Theodore E. Analytical orbits of close satellites of oblate planets.

At Berkeley the author described an exactly solvable Hamiltonian that represented, much more closely than could a Kepler ellipse, the motion of a close satellite of an oblate planet. A still better undisturbed Hamiltonian has recently been found.

The Hamiltonian H contains the principal oblateness effects,

$$H = \frac{1}{2} \left(p_r^2 + \frac{p_\theta^2}{r^2 \cos^2 \beta} + \frac{p_\beta^2}{r^2} \right) - \frac{1}{r} - \frac{B}{r^3} (1 - 3 \sin^2 \beta) \quad (1)$$

where the p 's are the generalized momenta corresponding to planetocentric radius r , right ascension θ and declination β , if time is suitably measured. Except in the equator the Hamiltonian H cannot be solved exactly but the unperturbed Hamiltonian H_0 , defined as $H - H_1$ and identical with H in the equator, can be. In

$$H_1 = 3B \left[\sin^2 \beta - \frac{1}{2} \sin^2 i \right] \left[\frac{1}{r^3} - \frac{1}{a^3} \right] \quad (2)$$

a is the mean distance and i is the maximum declination. An effort was made so to choose H_0 as to obtain canonical constants with only small secular perturbations. B of the earth, with unit equatorial radius, is about 0.00055. For a terrestrial satellite with a 1.13, eccentricity 0.067, and inclination 45° the first-order secular perturbations, of the canonical constants that replace the conventional π , Ω , and ϵ , appear at the time of writing to be but a few seconds of arc per period. Two more constants appear to lack first-order secular perturbations, and a sixth to have no perturbations at all.

Like that described in Berkeley, the exact solution of the new H_0 involves elliptic integrals that can be approximated by circular functions and by series in ascending powers of small quantities like B . It involves distinct sidereal, nodical, and anomalistic periods. With first-order perturbations included, the results should be much more accurate than a Kepler ellipse with first-order perturbations.

The author would welcome independent confirmation of the smallness of the secular perturbations, and hopes that others can find a still better H_0 .

*Smithsonian Astrophysical Observatory,
Cambridge, Mass.
and Harvard University,
Cambridge, Mass.*

Underhill, Anne B. Some observations of the Si lines in B-type stars.

The strengths of the lines $\text{Si II } \lambda 4130$, $\text{Si III } \lambda 4552$, and $\text{Si IV } \lambda 4089$ have been measured on high-dispersion plates for 10 B-type stars, and these data have been combined with published